

A NEW SPECIES OF *ZEIRAPHERA* TREITSCHKE (TORTRICIDAE)

CLIFFORD D. FERRIS

5405 Bill Nye Ave., R.R. 3, Laramie, WY 82070, USA, cdferris@uwyo.edu
 Research Associate: McGuire Center for Lepidoptera and Biodiversity, Florida Museum of Natural History,
 University of Florida, Gainesville, FL; C. P. Gillette Museum of Arthropod Diversity, Colorado State University,
 Ft. Collins, CO; Florida State Collection of Arthropods, Gainesville, FL.

AND

JAMES J. KRUSE

Interior Alaska Forest Entomologist, USDA Forest Service, State and Private Forestry, Forest Health Protection,
 Fairbanks Unit, 3700 Airport Way, Fairbanks, Alaska 99709, USA.

ABSTRACT. *Zeiraphera unfortunana* Ferris and Kruse is described from ninety specimens from Canada (type locality: Black Sturgeon Lake, Ontario) and Alaska with illustrations of the adults and genitalia. This species ranges from Nova Scotia to British Columbia, Yukon Territory, and Alaska into northern portions of the United States.

Additional key words: Alaska, Canada, taxonomy, Tortricidae, *Zeiraphera unfortunana*

The purpose of this article is to resolve a long-standing issue of nomenclature. What Mutuura and Freeman (1966) illustrated as *Zeiraphera destitutana* (Walker) in their review of the genus was recognized by Powell (1983; p. 35, entry 3242) as an undescribed species, for which he proposed the name *unfortunana*. Unfortunately this name is a *nomen nudum* because a description, diagnosis, and type designation were not provided (Brown, 2005, note 32, page 741). With Powell's agreement (pers. comm.), we herein correct this situation and provide the documentation required to make this name available in accordance with the International Code of Zoological Nomenclature. We initially proposed a different name, but after checking the numerous Internet citations for *unfortunana*, it became clear that additional confusion would result.

Some initial discussion of forewing maculation is appropriate. Nijhout (1978) formulated a model for wing pattern formation in Lepidoptera, with subsequent elaboration (Nijhout 1991, in Kristensen, 2003). His concepts were applied to the tortricid genera *Epiblema* Hübner by Brown & Powell (1991), and to *Argyroploce* Hübner by Baixeras (2002). *Epiblema* and *Zeiraphera* are assigned to the subfamily Olethreutinae tribe Eucosmini, while *Argyroploce* is placed in tribe Olethreutini. Several wing pattern definitions applied to and used in discussions of the Tortricidae are: fascia(e), the dark bands or areas in the pattern; strigula(e), the small pale transverse markings distributed along the costa and termen and situated between the veins; stria(e), lines or narrow bands that extend from the costal strigulae toward either the inner or outer wing margin. Strigulae may occur in pairs or fused into a

singular strigula; they denote the margins of fasciae. Strigulae may manifest substantial variation (plasticity) within a given species and even relative to the left and right wings of a single specimen. Expanded treatments of these pattern elements appear in Brown & Powell (1991, pp. 108–109) and Baixeras (2002, p. 425).

The habitus of many North American *Zeiraphera* tends to be “muddy” projecting a diffuse mottling of grays and browns with the strigulae poorly defined and obscure (especially in even only slightly worn specimens), and the edges of the fasciae indistinct. For this reason, we have not attempted to show the positions of all of the strigulae in *Zeiraphera*. For purposes of the current discussion, we recognize three principal fasciae in *Zeiraphera*, shown in Fig. 1 as F1 (subbasal fascia), F2 (median fascia), F3 (subapical fascia), with associated borders b1 – b4. F1 and F2 are transverse bands, while F3 is a spot of varying size and shape. The position of b1 is variable across species and within a given species. It may be close to b2, or extend nearly to the base. The feature p is a distal projection from b2 that may be acute (as shown) or blunt. In some instances, p may touch b3. Interfascial areas are paler, reflecting the wing ground color. The lightly shaded area R represents a pale interfascial spot that may or may not be present.

Fig. 2 illustrates the forewing venation in *Zeiraphera*, obtained by photographing (using back lighting) the wing after placing it on a glass slide and saturating it with 95% isopropanol to expose the veins. The veins on the resulting print were then traced in black ink, and the tracing scanned to produce the final digital image.

Here we offer some observations relative to the genus

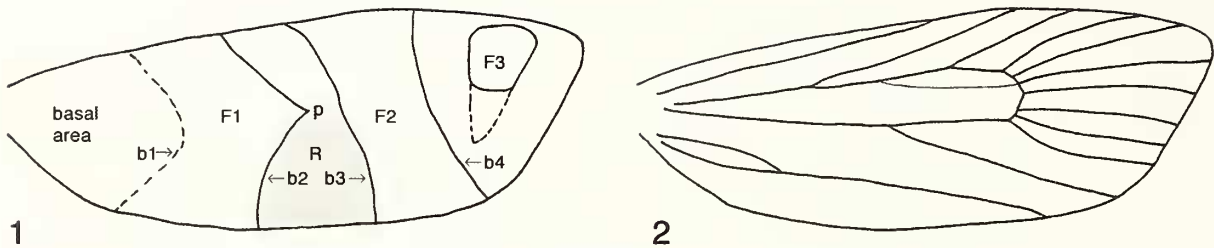


FIG. 1–2. (1) Wing plan adopted for this article showing principal fasciae. (2) Forewing venation in *Zeiraphera unfortunana*; female specimen from Porcupine Creek, Alaska (ex-pupa on *Picea glauca*).

in North America based on our own data, the literature cited, and various Internet sites. There are eight additional currently known species: *canadensis* Mutuura & Freeman; *claypoleana* (Riley); *fortunana* (Kearfott); *griseana* (Hübner) [we have specimens from the Fairbanks area, Alaska]; *hesperiana* Mutuura & Freeman; *improbana* (Walker); *pacifica* Freeman; *vancouverana* McDunnough. Eight species use conifers as larval hosts, while *claypoleana* uses *Aesculus glabra* Willdenow (Horse Chestnut, Ohio Buckeye). Adult maculation separates these species into three groups consisting of *claypoleana*, those that are generally not contrastingly marked or “muddy” in appearance (*griseana*, *hesperiana*, *improbana*, *pacifica*, *vancouverana*), and those that are normally contrastingly marked (*canadensis*, *fortunana*, *unfortunana*). When known, larval hosts can serve to separate some species. *Larix* is the primary larval host of *griseana* (Razowski, 2003) and *improbana*, while *Picea sitchensis* (Bong.) Carr. is preferred by *pacifica* and *vancouverana*, and *Pseudotsuga menziesii* (Mirbel) Franco is used by *hesperiana*. The remaining species use *Picea glauca* (Moench) Voss among other hosts. The wing pattern of *Z. claypoleana* differs from the general plan illustrated in Fig. 1 in that there is usually a broad band extending across the lower third of the forewing from the base nearly to the tornus. This band may be dark, pale, or mottled. When present, the fasciae F1 and F2 are poorly defined. In all species, the females generally exhibit more contrasted maculation than the males.

***Zeiraphera unfortunana* Ferris and Kruse, new species**
(Figs. 2–13)

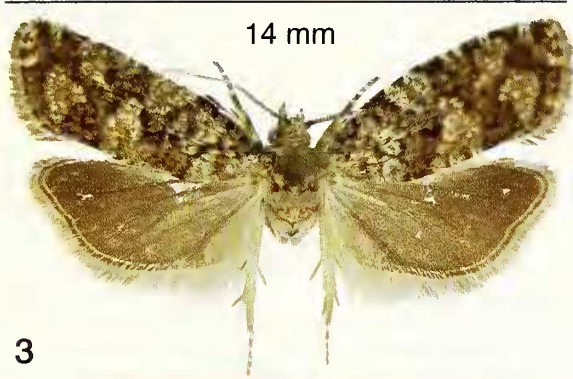
Zeiraphera unfortunana Powell, 1983, *nomen nudum*
Zeiraphera destitutana Mutuura & Freeman, 1966,
not Walker

Zeiraphera unfortunana Miller, 1987

Diagnosis. *Zeiraphera unfortunana* is most likely to be confused with *Z. canadensis* and *fortunana*. *Z.*

unfortunana has a checkered mosaic pattern (females especially) that is the most color contrasted pattern of the three species. Separation features are (with reference to Fig. 1): ground color of the interfasciac in *unfortunana* is white, ochreous in *canadensis*, pale gray or tan in *fortunana*, except b2–b3 white. F1 – F3 are medium brown (dark brown in some females); brownish-black in *canadensis* and *fortunana*. In F1 of *unfortunana* b1 is irregular, smeared, often extending to the base, and p is blunt; in *canadensis* F1 is generally narrow (especially toward costa) and often more darkly shaded along b2, and p is acute; in *fortunana* F1 may be rather poorly defined with a “blotchy” aspect, and p is blunt. F2 is slightly constricted midway and may be poorly defined above mid-wing; F2 in *canadensis* and *unfortunana* is usually well expressed, sometimes paling in color in *canadensis* toward the costa. F3 in *canadensis* is large and produced toward the tornus; small and restricted to apical region in *fortunana*; large, brown and irregular in *unfortunana* usually with a prominent irregular orange-brown vertical bar extending from the lower edge toward the tornus in the interfascial region. In *fortunana* the margins b2 and b3 are roughly parallel with R rectangular; R is approximately triangular in *canadensis* and *unfortunana*. In *canadensis*, R is pale brownish-tan speckled with brownish scales; in *unfortunana* R is white speckled (heavily in some males) with brown and ochreous scales. The uncus in male *canadensis* is well developed and triangular; in *fortunana* it is reduced and truncated with a slightly notched apex; in *unfortunana* it is poorly developed with an entire (unnotched) apex.

Description. MALE (Fig. 3). *Head.* Frons and vertex with a mixture of grayish-white and brown scales; palpi pale grayish-white inwardly, outwardly mostly brown, slightly longer than eye width; ocellus present. Antenna brown with narrow darker brown band at distal end of each segment. *Thorax.* Brown scales dorsad, whitish ventrad. *Legs.* Prothoracic and mesothoracic legs with mottled appearance produced by dark brown and paler scales, not clearly ringed or checkered; hind legs pale whitish-tan and unmarked. *Abdomen.* Appears brown, but clothed with a mixture of brown and paler gray scales. *Wings.* Expanse 14–17 mm, n = 17 (FW length of holotype 6.5 mm). Forewings very mottled in aspect with brown, pale brown, and pale gray to grayish-white scales; mottled brown basal area extending distad to darker brown subbasal fascia F1, with P blunt;



3

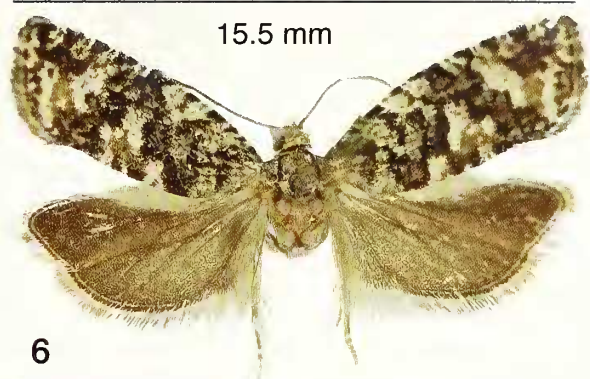
Zeiraphera unfortunana
 Ferris & Kruse
 HOLOTYPE

No. 110
 Picea glauca
 R'd *coll.*

Black Sturgeon Lake,
 Ontario
 Em. 9-VII-62
 Incubated Insectary

CNC
 genitalia slide
 TOR-841 ♂

4



6

Zeiraphera unfortunana
 Ferris & Kruse
 Paratype

206
 Picea glauca
 R'd

Black Sturgeon Lake,
 Ontario
 Em. 10-VII-63
 Incubated Insectary

CNC
 genitalia slide
 TOR-613 ♀

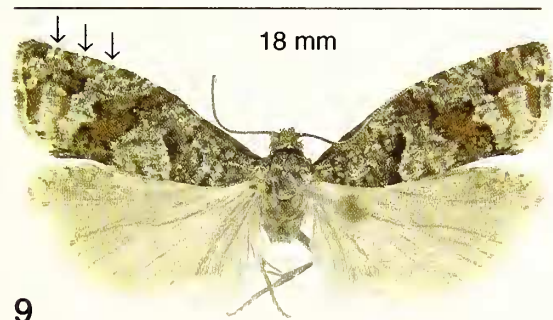
7



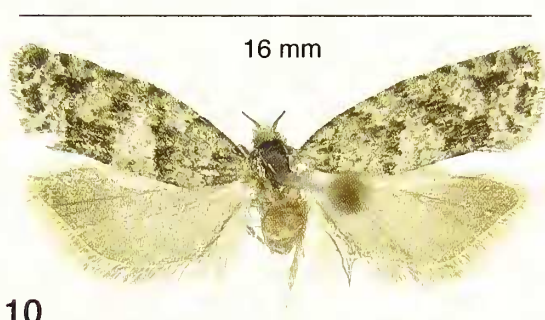
5



8

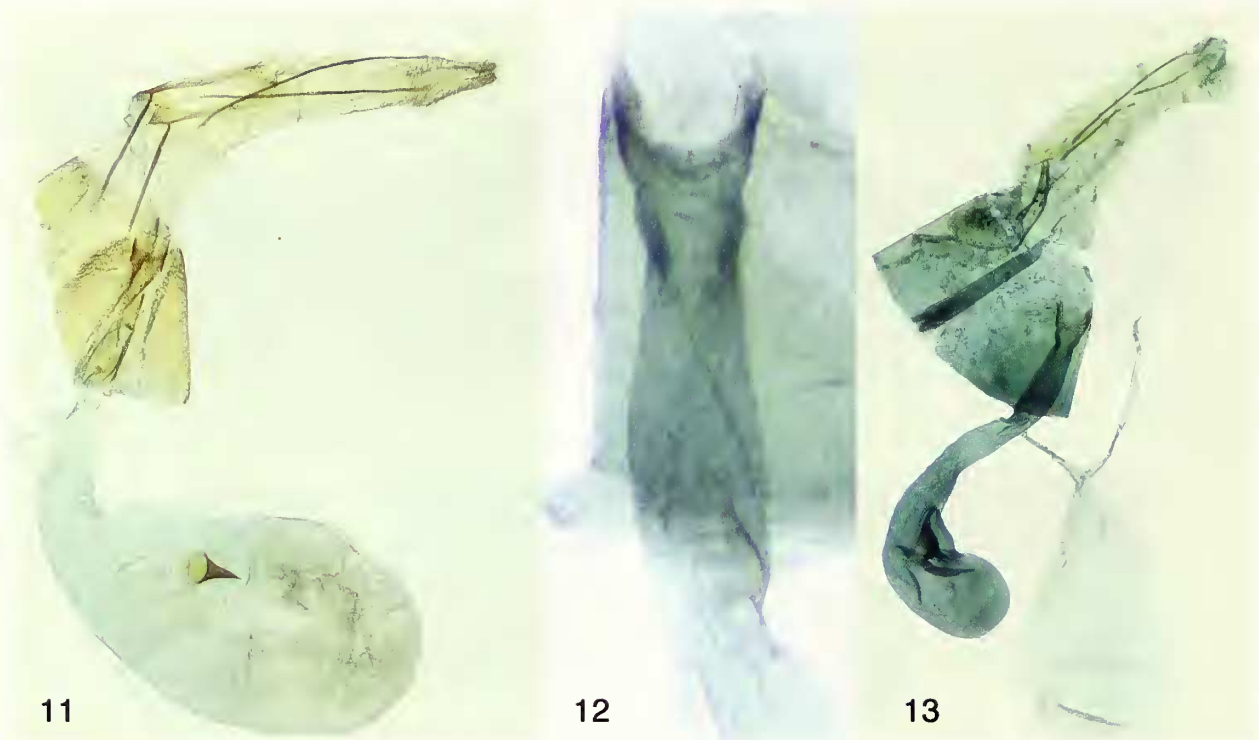


9



10

FIGS. 3-10. *Zeiraphera unfortunana* Ferris and Kruse: 3, holotype male; 4, male pin labels; 5, genitalia of holotype; 6, paratype female; 7, female pin labels; 8-10, female specimens from interior Alaska; arrows in 9 point to strigulae.



FIGS. 11–13. *Zeiraphera unfortunana* female genitalia of Alaskan specimens: **11**, Fairbanks area; **12–13**, Porcupine Creek: **12**, sterigma and ductus bursae; **13**, complete genitalia showing large bursa seminalis.

irregular paler mottled median triangular patch (dorsal patch R) extends from inner margin with blunt apex at mid-wing; median fascia F2 mottled brown band followed by a paler irregular broad interfascial area with included narrower vertical orange-brown band; F3 brown; segmented dark brown terminal line, fringe dark grayish-brown scales, fading at tips. Hindwing uniformly brownish-fuscous with narrow whitish outer-margin line, then brown line at base of fringe; fringe slightly paler than wing. Wings ventrally fuscous; hindwings paler than forewings. *Genitalia* (Fig. 5; 17 dissections, CNC slides nos. TOR-613, 616, 620, 621, 680–682, 821–823, 825–827, 829–832, 841). Uncus poorly developed but entire; tegumen round shouldered; cucullus broad, apically rounded; number of cornuti variable from approximately 24–40 spines. FEMALE (Figs. 6, 8–13). Similar to male in most respects, but dorsal forewing maculation dark and pale areas more contrasted, interfascial area ground color white. *Genitalia*. (Figs. 11–13; 17 dissections, CNC slides nos. TOR-617–619, 622, 676–679, 683–685, 824, 828; 3 Alaska specimens by Ferris). Papillae anales setose elongated ovals; apophyses long and slender (anterior to posterior ratio ca. 0.5); ostium bursae moderately sclerotized, ductus bursae lightly sclerotized from ostium to just above junction with ductus seminalis, incomplete colliculum (sterigma ring) (Fig. 12); corpus bursae elongate with one prominent conical signum (Fig. 11); large bursa seminalis (Figs. 13).

Types. Although ninety specimens were examined, because of the confusion surrounding this moth, we have selected for the type series only reared specimens that have been dissected for genitalic examination as follows: a typical male (*holotype*) and 16 male and 14 female *paratypes* from the type locality from a reared series of *unfortunana* in the Canadian National Collection of Insects, Arachnids and Nematodes (CNC), Ottawa, Ontario, Canada. The type locality is the collection site for specimens illustrated (adults and genitalia) by Mutunra and Freeman (1966, Figs. 16–17, 31, 42) as “destitutana.” The holotype male and paratypes are placed in the CNC, Ottawa, Ontario, Canada. *Type locality*: Black Sturgeon Lake, Ontario, Canada.

Variation ($n = 90$, Alaska and Canada). Dorsal forewing maculation is rather variable in pattern and coloration, and no two individuals were identical in the material examined. Wild caught specimens (Figs. 8–10) have a more subdued aspect from reared material (Figs. 3, 6).

Biology and distribution. Although we know of no print publications that describe the biology, there are numerous Internet sites that provide information with descriptions and photographs of the mature larvae, two of which are Forest Pests (www.forestpests.org) and Natural Resources Canada, Canadian Forest Service (search *Zeiraphera unfortunana*/purple-striped shootworm). The principal larval host is *Picea glauca* (white spruce), but other hosts reported in the literature include *P. englemanni* Parry, *P. stichensis* (Bong.) Carr., *Abies balsamea* (L.) Mill., *A. lasiocarpa* (Hook.) Nutt., and *A. amabilis* (Dougl.) Forbes. There is one generation with last instar larvae from May to July, and adults from July into early August. The overwintering egg is laid near the base of new growth shoots. This species ranges from Nova Scotia to British Columbia, Yukon Territory, and Alaska; also Michigan and Minnesota (Miller, 1987). Internet sites imply occurrence in the northeastern United States, but no specific localities were found. To date, we have seen

only female specimens from Alaska, where collection localities include Chena Ridge above Fairbanks, Sterling (Kenai Peninsula), and Porcupine Butte in south-central Alaska, 61.9317°N, 151.9886°W (NADS3/WGSS84) (ex-pupa on *Picea glauca*).

ACKNOWLEDGEMENTS

We thank James T. Troubridge and Jocelyn Gill, Agriculture and Agri-Food Canada (CNC), Ottawa, Ontario, Canada for supplying digital photographs of moths, labels, and genitalia. K. W. Philip, Fairbanks, Alaska, Dominique Collet, Sterling, Alaska, and Ken Zogas, Alaska Reference Collection System, USDAFS Anchorage kindly provided material for examination. John W. Brown, National Museum of Natural History, Washington, DC graciously reviewed a preliminary draft of the manuscript prior to submission. William E. Miller and an anonymous reviewer provided helpful suggestions. This study was supported in part by USDA Chugach National Forest, Anchorage, Alaska (order no. 43-0120-4-0140).

LITERATURE CITED

- BAIXERAS, J. 2002. An overview of genus-level taxonomic problems surrounding *Argyroploce* Hübner (Lepidoptera: Tortricidae), with description of a new species. *Ann. Entomol. Soc. Am.* 95(4):422–431.
- BROWN, J.W. 2005. World catalogue of insects, volume 5, Tortricidae (Lepidoptera). Stenstrup, Denmark. 741 pp.
- BROWN, R.L. & J.A. POWELL. 1991. Description of a new species of *Epiblema* (Lepidoptera: Tortricidae: Olethreutinae) from coastal redwood forests in California with analysis of the forewing pattern. *Pan-Pacif. Entomol.* 67(2):107–114.
- KRISTENSEN, N.P. (vol. ed). 2003. Handbook of zoology Vol. 4, Part 36. de Gruyter, Berlin. xii + 564 pp.
- MILLER, W.E. 1987. Guide to the Olethreutine moths of midland North America (Tortricidae). USDA, Forest Service, Agriculture Handbook 660.
- MUTUURA, A. & T.N. FREEMAN. 1966. The North American species of the genus *Zeiraphera*. *J. Res. Lepid.* 5(3):153–176.
- NIJHOOT, H.F. 1978. Wing pattern formation in Lepidoptera: a model. *J. Exp. Zool.* 206:119–136.
- . 1991. The development and evolution of butterfly wing patterns. Smithsonian Institution Press, Washington and London. xvi + 297 pp.
- POWELL, J.A. 1983 IN HODGES, R. W., et al., (Eds.). Check list of the Lepidoptera of America north of Mexico. E. W. Classey, Ltd. and the Wedge Entomological Research Foundation, London. xxiv + 284 pp.
- RAZOWSKI, J. 2003. Tortricidae of Europe, Volume 2. Olethreutinae. Bratislava. 301 pp.

Received for publication 8 June 2007; revised and accepted 28 September 2007.